ST.JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
B.Sc. PHYSICS -V SEMESTER
SEMESTER EXAMINATION-OCTOBER 2019

PH 5115: ELECTRONICS AND RELATIVITY.

Time: 2½ hours **Max.Marks:70**

This question paper has **two** printed pages and **three** parts

PART-A

Answer any **Four** of following: (4x10=40)

1. a) With the circuit diagram explain the action of transistor(CE) as an amplifier.
   b) Define α and β of a transistor. (8+2)

2. a) Explain the construction of JFET.
   b) With a circuit diagram explain the drain and transfer characteristics of JFET. (2+8)

3.a) Explain the working of phase shift oscillator with a circuit diagram and discuss the condition for frequency of oscillation.
   b) Give the construction and working of differentiator circuit using operational amplifier. (5+5)

4. a) What is a logic gate? Explain the construction and working of AND, OR gates using diodes. Give the truth table of them.
   b) State and prove De-Morgan's theorem. (7+3)

5. a) Define proper length and proper time. Derive an expression for length contraction.
   b) State the postulates of special theory of relativity. (7+3)

6. Describe Michelson-Morley experiment and discuss the negative result. (10)

PART-B

Solve any **Four** of the following: (4x5=20)

7. A transistor is connected in CE configuration. Draw the d.c.load line and determine the operating point .Given: V_{cc} =12V,R_c =6 kΩ, I_B=20 μA, $\boldsymbol{\beta} = 50$.

8. In a Hartley Oscillator L_1 =0.2mH, L_2 = 20μH and M = 40μH.Find the value of capacitor of the oscillatory circuit to obtain a frequency of 4.1MHz.

9. A JFET has I_D of 5mA. If the shorted gate drain current is I_{DSS}= 10mA and $V_{GS(off)}$ = -6V. Find the values of V_{GS} and V_P.

10. An atomic particle has a rest mass of $3x10^{-25}$ kg. Find its total energy when (i) It is at rest and (ii) It has a velocity of 0.8c.

11. Calculate the velocity of an elementary particle, whose mass is 10 times its rest mass.

12. In an inverting amplifier if R_i =10kΩ, R_f =100kΩ and the supply voltages are ± 18V, find (i) closed loop voltage gain (ii) Input impedance (III) Maximum operating frequency. Given: V_{in} =1 V_{pp}, the slew rate=0.5V/μs

PART-C

Answer any **Five** of the following: (5x2=10)

13. (a) α of a transistor is unity still it is called as current gain. Why?

(b) What is the basic condition for the proper functioning of a transistor as an amplifier?

(c) Even though the gain in open loop condition of an op amp is quite large, but it is seldom used. Why?

(d) Which gate is called universal gate? Justify.

(e) Why the ideas of relativity seems to be strange in day to day life? Explain.

(f) If momentum is conserved in a collision of two as measured on a uniformly moving train, is it also conserved for the ground observer? Explain.